APPENDIX Index – Formula One Rear Wing Optimization

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APPENDIX A – JAVA Macro for StarCCM+ modeling

From the original StarCCM+ model (reduced mesh), it imports the new geometry and creates the mesh for the simulation.

NACA.MOD

```
// STAR-CCM+ macro: NACA.java
package macro;

import java.util.*;

import star.common.*;
import star.base.neo.*;
import star.vis.*;
import star.base.report.*;
import star.flow.*;
import star.meshing.*;

public class NACA extends StarMacro {

  public void execute() {
    execute0();
  }

  private void execute0() {

    Simulation simulation_0 =
      getActiveSimulation();

    Units units_0 =
      simulation_0.getUnitsManager().getPreferredUnits(new IntVector(new int[] {0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0}));

    ImportManager importManager_0 =
      simulation_0.getImportManager();

    importManager_0.importStlSurface(resolvePath("C:\\TEMPORAL\\Modefrontier\\NACA_PROFILE\\BW.stl"),
"OneBoundaryPerPatch", units_0, true, 1.0E-8);

    SurfaceRep surfaceRep_0 =
      ((SurfaceRep) simulation_0.getRepresentationManager().getObject("Import"));

    Region region_0 =
      simulation_0.getRegionManager().getRegion("Region 1");

    surfaceRep_0.generateMeshReport(new NeoObjectVector(new Object[] {region_0}));


importManager_0.importStlSurface(resolvePath("C:\\TEMPORAL\\Modefrontier\\NACA_PROFILE3D\\NACA_BSL02_3D_V5.stl"),
"OneBoundaryPerPatch", units_0, true, 1.0E-8);

    Region region_1 =
      simulation_0.getRegionManager().getRegion("Region 2");

    surfaceRep_0.generateMeshReport(new NeoObjectVector(new Object[] {region_1}));
```

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```
importManager_0.importStlSurface(resolvePath("C:\\TEMPORAL\\Modefrontier\\NACA_PROFILE3D\\NACASYM_BSL02_3D_V5.stl"), "OneBoundaryPerPatch", units_0, true, 1.0E-8);

    Region region_2 =
      simulation_0.getRegionManager().getRegion("Region 3");

    surfaceRep_0.generateMeshReport(new NeoObjectVector(new Object[] {region_2}));

    Boundary boundary_0 =
      region_0.getBoundaryManager().getBoundary("catia");

    boundary_0.setPresentationName("BODYWORK");

    Region region_3 =
      simulation_0.getRegionManager().getRegion("TUNNEL_CAR");

    Boundary boundary_1 =
      region_3.getBoundaryManager().getBoundary("BODYWORK");

    boundary_0.get(MeshConditionManager.class).copyProperties(boundary_1.get(MeshConditionManager.class));

    boundary_0.get(MeshValueManager.class).copyProperties(boundary_1.get(MeshValueManager.class));

    region_3.getBoundaryManager().removeBoundaries(new NeoObjectVector(new Object[] {boundary_1}));

    surfaceRep_0.combineRegions(new NeoObjectVector(new Object[] {region_3, region_0}));

    Boundary boundary_2 =
      region_1.getBoundaryManager().getBoundary("catia");

    boundary_2.setPresentationName("Rear_wing_test1");

    Boundary boundary_3 =
      region_3.getBoundaryManager().getBoundary("Rear_wing_test1");

    boundary_2.get(MeshConditionManager.class).copyProperties(boundary_3.get(MeshConditionManager.class));

    boundary_2.get(MeshValueManager.class).copyProperties(boundary_3.get(MeshValueManager.class));

    region_3.getBoundaryManager().removeBoundaries(new NeoObjectVector(new Object[] {boundary_3}));

    surfaceRep_0.combineRegions(new NeoObjectVector(new Object[] {region_3, region_1}));

    Boundary boundary_4 =
      region_2.getBoundaryManager().getBoundary("catia");

    boundary_4.setPresentationName("SYM");

    Boundary boundary_5 =
      region_3.getBoundaryManager().getBoundary("SYM");

    boundary_4.get(MeshConditionManager.class).copyProperties(boundary_5.get(MeshConditionManager.class));

    boundary_4.get(MeshValueManager.class).copyProperties(boundary_5.get(MeshValueManager.class));

    boundary_4.setBoundaryType(SymmetryBoundary.class);

    region_3.getBoundaryManager().removeBoundaries(new NeoObjectVector(new Object[] {boundary_5}));

    surfaceRep_0.combineRegions(new NeoObjectVector(new Object[] {region_3, region_2}));

    FeatureCurve featureCurve_0 =
```

```
    ((FeatureCurve) region_3.getFeatureCurveManager().getObject("CAR_CURVES"));

  region_3.getFeatureCurveManager().removeObjects(featureCurve_0);

  FeatureCurve featureCurve_1 =
    ((FeatureCurve) region_3.getFeatureCurveManager().getObject("TUNNEL_CURVES"));

  region_3.getFeatureCurveManager().removeObjects(featureCurve_1);

  Boundary boundary_6 =
    region_3.getBoundaryManager().getBoundary("INLET");

  Boundary boundary_7 =
    region_3.getBoundaryManager().getBoundary("OUTLET");

  Boundary boundary_8 =
    region_3.getBoundaryManager().getBoundary("GROUND_PRISM");

  Boundary boundary_9 =
    region_3.getBoundaryManager().getBoundary("TUNNEL");

  Boundary boundary_10 =
    region_3.getBoundaryManager().getBoundary("GROUND");

  FeatureCurve featureCurve_2 =
    surfaceRep_0.createFeatureEdgesOnBoundaries(new NeoObjectVector(new Object[] {boundary_6, boundary_7, boundary_8,
boundary_9, boundary_4, boundary_10}), true, true, true, true, true, true, 31.0);

  featureCurve_2.setPresentationName("Tunnel_curves");

  Boundary boundary_11 =
    region_3.getBoundaryManager().getBoundary("TYRE");

  Boundary boundary_12 =
    region_3.getBoundaryManager().getBoundary("RL_WISHBONES");

  Boundary boundary_13 =
    region_3.getBoundaryManager().getBoundary("RIM");

  Boundary boundary_14 =
    region_3.getBoundaryManager().getBoundary("RL_CALIPER");

  Boundary boundary_15 =
    region_3.getBoundaryManager().getBoundary("RL_DRUM");

  Boundary boundary_16 =
    region_3.getBoundaryManager().getBoundary("DIFFUSER");

  Boundary boundary_17 =
    region_3.getBoundaryManager().getBoundary("UNDERFLOOR");

  Boundary boundary_18 =
    region_3.getBoundaryManager().getBoundary("RL_DISC");

  FeatureCurve featureCurve_3 =
    surfaceRep_0.createFeatureEdgesOnBoundaries(new NeoObjectVector(new Object[] {boundary_11, boundary_12,
boundary_13, boundary_14, boundary_15, boundary_16, boundary_17, boundary_0, boundary_18, boundary_2}), true, true, true,
true, true, true, 31.0);

  featureCurve_3.setPresentationName("Car_curves");

  Scene scene_0 =
    simulation_0.getSceneManager().createScene("Repair Surface");
```

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```
scene_0.initializeAndWait();

SurfaceMeshWidget surfaceMeshWidget_0 =
  surfaceRep_0.startSurfaceMeshWidget(scene_0);

surfaceMeshWidget_0.setActiveRegions(new NeoObjectVector(new Object[] {region_3}));

surfaceMeshWidget_0.startSurfaceMeshDiagnostics();

surfaceMeshWidget_0.startSurfaceMeshRepair();

surfaceMeshWidget_0.startMergeImprintController();

surfaceMeshWidget_0.startIntersectController();

SurfaceMeshWidgetDiagnosticsController surfaceMeshWidgetDiagnosticsController_0 =
  surfaceMeshWidget_0.getControllers().getController(SurfaceMeshWidgetDiagnosticsController.class);

surfaceMeshWidgetDiagnosticsController_0.setCheckPiercedFaces(true);

surfaceMeshWidgetDiagnosticsController_0.setPiercedFacesActive(true);

surfaceMeshWidgetDiagnosticsController_0.setCheckPoorQualityFaces(true);

surfaceMeshWidgetDiagnosticsController_0.setPoorQualityFacesActive(true);

surfaceMeshWidgetDiagnosticsController_0.setMinimumFaceQuality(0.01);

surfaceMeshWidgetDiagnosticsController_0.setCheckCloseProximityFaces(true);

surfaceMeshWidgetDiagnosticsController_0.setCloseProximityFacesActive(true);

surfaceMeshWidgetDiagnosticsController_0.setMinimumFaceProximity(0.05);

surfaceMeshWidgetDiagnosticsController_0.setCheckFreeEdges(true);

surfaceMeshWidgetDiagnosticsController_0.setFreeEdgesActive(true);

surfaceMeshWidgetDiagnosticsController_0.setCheckNonmanifoldEdges(true);

surfaceMeshWidgetDiagnosticsController_0.setNonmanifoldEdgesActive(true);

surfaceMeshWidgetDiagnosticsController_0.setCheckNonmanifoldVertices(true);

surfaceMeshWidgetDiagnosticsController_0.setNonmanifoldVerticesActive(true);

surfaceMeshWidgetDiagnosticsController_0.setCheckFeatureNumberEdges(true);

surfaceMeshWidgetDiagnosticsController_0.setCheckFeatureLength(false);

surfaceMeshWidgetDiagnosticsController_0.setCheckFeatureAngle(true);

surfaceMeshWidgetDiagnosticsController_0.setCheckFeatureOpenCurve(true);

surfaceMeshWidgetDiagnosticsController_0.setCheckFeatureSmallRegions(false);

surfaceMeshWidgetDiagnosticsController_0.setMinNumberEdges(5);

surfaceMeshWidgetDiagnosticsController_0.setMinFeatureLength(1.0E-4);

surfaceMeshWidgetDiagnosticsController_0.setMaxFeatureAngle(121.0);
```

```
    surfaceMeshWidgetDiagnosticsController_0.setMinFeatureRegionArea(1.0E-4);

    surfaceMeshWidgetDiagnosticsController_0.runDiagnostics();

    surfaceMeshWidgetDiagnosticsController_0.setCheckSoftFeatureErrors(false);

    surfaceMeshWidgetDiagnosticsController_0.setSoftFeatureErrorsActive(false);

    surfaceMeshWidgetDiagnosticsController_0.setCheckHardFeatureErrors(false);

    surfaceMeshWidgetDiagnosticsController_0.setHardFeatureErrorsActive(false);

    surfaceMeshWidgetDiagnosticsController_0.setCheckSoftFeatureErrors(false);

    surfaceMeshWidgetDiagnosticsController_0.setSoftFeatureErrorsActive(false);

    surfaceMeshWidgetDiagnosticsController_0.setCheckHardFeatureErrors(false);

    surfaceMeshWidgetDiagnosticsController_0.setHardFeatureErrorsActive(false);

    SurfaceMeshWidgetRepairController surfaceMeshWidgetRepairController_0 =
      surfaceMeshWidget_0.getControllers().getController(SurfaceMeshWidgetRepairController.class);

    SurfaceMeshWidgetMergeImprintOptions surfaceMeshWidgetMergeImprintOptions_0 =
      surfaceMeshWidgetRepairController_0.getOptions().getMergeImprintOptions();


surfaceMeshWidgetMergeImprintOptions_0.setMergeAction(SurfaceMeshWidgetMergedFaceOption.MAINTAIN_DEST_BOUNDA
RY);

    PartDisplayer partDisplayer_0 =
      ((PartDisplayer) scene_0.getHighlightDisplayer());

    partDisplayer_0.initialize();

    SurfaceMeshWidgetDisplayer surfaceMeshWidgetDisplayer_0 =
      ((SurfaceMeshWidgetDisplayer) scene_0.getDisplayerManager().getDisplayer("Widget displayer 1"));

    surfaceMeshWidgetDisplayer_0.initialize();

    CurrentView currentView_0 =
      scene_0.getCurrentView();

    currentView_0.setInput(new DoubleVector(new double[] {0.0, 0.0, 0.0}), new DoubleVector(new double[] {0.0, 0.0, 1.0}), new
DoubleVector(new double[] {0.0, 1.0, 0.0}), -1.0, 0);

    surfaceMeshWidgetDiagnosticsController_0.selectFreeEdges();

    surfaceMeshWidgetRepairController_0.zipSelectedEdges();

    surfaceMeshWidgetDiagnosticsController_0.setCheckSoftFeatureErrors(false);

    surfaceMeshWidgetDiagnosticsController_0.setSoftFeatureErrorsActive(false);

    surfaceMeshWidgetDiagnosticsController_0.setCheckHardFeatureErrors(false);

    surfaceMeshWidgetDiagnosticsController_0.setHardFeatureErrorsActive(false);

    surfaceMeshWidgetDiagnosticsController_0.selectNonmanifoldEdges();

    surfaceMeshWidget_0.stop();

    simulation_0.getSceneManager().deleteScenes(new NeoObjectVector(new Object[] {scene_0}));
```

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```
    Solution solution_0 =
      simulation_0.getSolution();

    solution_0.clearSolution();

    ForceReport forceReport_0 =
      ((ForceReport) simulation_0.getReportManager().getReport("Fx"));

    forceReport_0.getParts().setObjects(boundary_2);

    ForceReport forceReport_1 =
      ((ForceReport) simulation_0.getReportManager().getReport("Fz"));

    forceReport_1.getParts().setObjects(boundary_2);

    MeshPipelineController meshPipelineController_0 =
      simulation_0.get(MeshPipelineController.class);

    meshPipelineController_0.generateVolumeMesh();

    simulation_0.saveState(resolvePath("C:\\TEMPORAL\\Modefrontier\\NACA_PROFILE3D\\NACA_MOD3D.sim"));
  }
}
```

APPENDIX B – JAVA Macro for StarCCM+ simulation

It launches the simulation and generates the graphs of drag and downforce.

NACA_MOD.JAVA

```
// STAR-CCM+ macro: NACA_MOD.java
package macro;

import java.util.*;

import star.common.*;
import star.base.neo.*;
import star.base.report.*;
import star.flow.*;

public class NACA_MOD extends StarMacro {

  public void execute() {
    execute0();
  }

  private void execute0() {

    Simulation simulation_0 =
      getActiveSimulation();

    StepStoppingCriterion stepStoppingCriterion_0 =
      ((StepStoppingCriterion)
simulation_0.getSolverStoppingCriterionManager().getSolverStoppingCriterion("Maximum Steps"));

    stepStoppingCriterion_0.setMaximumNumberSteps(1000);

    Solution solution_0 =
      simulation_0.getSolution();

    solution_0.initializeSolution();

    solution_0.initializeSolution();

    ResidualPlot residualPlot_0 =
      ((ResidualPlot) simulation_0.getPlotManager().getObject("Residuals"));

    residualPlot_0.setTitleFont(new java.awt.Font("SansSerif", 0, 12));

    simulation_0.getSimulationIterator().run();

    MonitorPlot monitorPlot_0 =
      simulation_0.getPlotManager().createMonitorPlot();

    monitorPlot_0.setPresentationName("Fx Plot");

    ForceReport forceReport_0 =
      ((ForceReport) simulation_0.getReportManager().getReport("Fx"));
```

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```
ReportMonitor reportMonitor_0 =
  forceReport_0.createMonitor();

monitorPlot_0.getMonitors().addObjects(reportMonitor_0);

monitorPlot_0.setTitleFont(new java.awt.Font("SansSerif", 0, 12));

Axes axes_0 =
  monitorPlot_0.getAxes();

Axis axis_0 =
  axes_0.getXAxis();

AxisTitle axisTitle_0 =
  axis_0.getTitle();

axisTitle_0.setText("Iteration");

Axis axis_1 =
  axes_0.getYAxis();

AxisTitle axisTitle_1 =
  axis_1.getTitle();

axisTitle_1.setText("Force (N)");

MonitorPlot monitorPlot_1 =
  simulation_0.getPlotManager().createMonitorPlot();

monitorPlot_1.setPresentationName("Fz Plot");

ForceReport forceReport_1 =
  ((ForceReport) simulation_0.getReportManager().getReport("Fz"));

ReportMonitor reportMonitor_1 =
  forceReport_1.createMonitor();

monitorPlot_1.getMonitors().addObjects(reportMonitor_1);

monitorPlot_1.setTitleFont(new java.awt.Font("SansSerif", 0, 12));

Axes axes_1 =
  monitorPlot_1.getAxes();

Axis axis_2 =
  axes_1.getXAxis();

AxisTitle axisTitle_2 =
  axis_2.getTitle();

axisTitle_2.setText("Iteration");

Axis axis_3 =
  axes_1.getYAxis();

AxisTitle axisTitle_3 =
  axis_3.getTitle();
```

```
    axisTitle_3.setText("Force (N)");

    stepStoppingCriterion_0.setMaximumNumberSteps(1501);

    simulation_0.getSimulationIterator().run();

    MonitorPlot monitorPlot_2 =
      ((MonitorPlot) simulation_0.getPlotManager().getObject("Fx Plot"));

    monitorPlot_2.setTitleFont(new java.awt.Font("SansSerif", 0, 12));

    monitorPlot_2.export(resolvePath("C:\\TEMPORAL\\Modefrontier\\NACA_PROFILE3D\\fx_extended.csv"), ",");

    MonitorPlot monitorPlot_3 =
      ((MonitorPlot) simulation_0.getPlotManager().getObject("Fz Plot"));

    monitorPlot_3.setTitleFont(new java.awt.Font("SansSerif", 0, 12));

    monitorPlot_3.export(resolvePath("C:\\TEMPORAL\\Modefrontier\\NACA_PROFILE3D\\fz_extended.csv"), ",");

    monitorPlot_0.export(resolvePath("C:\\TEMPORAL\\Modefrontier\\NACA_PROFILE3D\\fx.tab"), ",");

    monitorPlot_1.export(resolvePath("C:\\TEMPORAL\\Modefrontier\\NACA_PROFILE3D\\fz.tab"), ",");
  }
}
```

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APPENDIX C - Example of Summary Report from StarCCM+

Summary Report: NACA_MOD3D@01501

Session Summary

Date	15-Dec-2010 08:20:52
Simulation	C:\Documents and Settings\metca126\Desktop\NACA_MOD3D@01501.sim
File size	7.9e+02 MB
Number of Partitions	1
Number of Restored Partitions	1

Software Summary

Version	BuildArch: win64 BuildEnv: intel11.1 ReleaseDate: 2010-07-24 00:29:45 GMT ReleaseNumber: 5.04.008

Hardware Summary

Hosts	Controller: eemetca124 Number of Workers: 0

Simulation Properties

1 **NACA_MOD3D@01501**		
+-1 Parts		
+-2 3D-CAD Models		
+-3 Continua	Continua	3
| +-1 **K_epsilon**	Interfaces	[]
| | |	Regions	[]
| | +-1 Models		
| | | +-1 Cell Quality Remediation		
| | | +-2 Constant Density		
| | | +-3 Gas		
| | | | `-1 **Air**	Database Material	Air (Air) [Standard/Gases]
| | | | `-1 Material Properties		
| | | | +-1 Density	Method	Constant
| | | | | `-1 Constant	Value	1.18415 kg/m^3
| | | | `-2 Dynamic Viscosity	Method	Constant
| | | | `-1 Constant	Value	1.85508E-5 Pa-s
| | | +-4 K-Epsilon Turbulence		
| | | +-5 Realizable K-Epsilon Two-Layer	Two-Layer Type	Shear Driven (Wolfstein)
| | | |	Normal Stress Term	false
| | | |	Two-Layer ReY*	60.0
| | | |	Two-Layer Delta ReY	10.0
| | | |	Secondary Gradients	On
| | | |	Convection	2nd-order
| | | |	Buoyancy Production of Dissipation	Boundary Layer Orientation
| | | |	Cmu	0.09
| | | |	C1e	1.44
| | | |	C2e	1.9
| | | |	Ct	1.0
| | | |	Sigma_k	1.0
| | | |	Sigma_e	1.2
| | | |	Sarkar	2.0
| | | |	Tke Minimum	1.0E-10
| | | |	Tdr Minimum	1.0E-10
| | | +-6 Reynolds-Averaged Navier-Stokes		
| | | +-7 Segregated Flow	Minimum Absolute Pressure	1000.0 Pa
| | | |	Secondary Gradients	On
| | | |	Convection	2nd-order

| | | +-8 Steady		
| | | +-9 Three Dimensional		
| | | +-10 Turbulent		
| | | `-11 Two-Layer All y+ Wall Treatment		
| | +-2 Reference Values		
| | | +-1 Minimum Allowable Wall Distance	Value	0.0010 mm
| | | `-2 Reference Pressure	Value	101325.0 Pa
| | `-3 Initial Conditions		
| | +-1 Pressure	Method	Constant
| | | `-1 Constant	Value	0.0 Pa
| | +-2 Turbulence Specification	Method	K + Epsilon
| | +-3 Turbulent Dissipation Rate	Method	Constant
| | | `-1 Constant	Value	182000.0 J/kg-s
| | +-4 Turbulent Kinetic Energy	Method	Constant
| | | `-1 Constant	Value	18.0 J/kg
| | `-5 Velocity	Coordinate System	Laboratory
| | |	Method	Constant
| | `-1 Constant	Value	[69.44, 0.0, 0.0] m/s
| +-2 **K_omega**	Interfaces	[]
| | |	Regions	[TUNNEL_CAR]
| | +-1 Models		
| | | +-1 All y+ Wall Treatment		
| | | +-2 Constant Density		
| | | +-3 Gas		
| | | | `-1 **Air**	Database Material	Air (Air) [Standard/Gases]
| | | | `-1 Material Properties		
| | | | +-1 Density	Method	Constant
| | | | | `-1 Constant	Value	1.225 kg/m^3
| | | | `-2 Dynamic Viscosity	Method	Constant
| | | | `-1 Constant	Value	1.72725E-5 Pa-s
| | | +-4 K-Omega Turbulence		
| | | +-5 Reynolds-Averaged Navier-Stokes		
| | | +-6 Segregated Flow	Minimum Absolute Pressure	1000.0 Pa
| | | |	Secondary Gradients	On
| | | |	Convection	2nd-order
| | | +-7 SST (Menter) K-Omega	a1	0.31
| | | | |	Kappa	0.41
| | | | |	BetaStar	0.09
| | | | |	Beta1	0.075
| | | | |	Sigma_k1	0.85
| | | | |	Sigma_w1	0.5
| | | | |	Beta2	0.0828
| | | | |	Sigma_k2	1.0
| | | | |	Sigma_w2	0.856
| | | | |	Secondary Gradients	On
| | | | |	Convection	2nd-order
| | | | |	Normal Stress Term	false
| | | | |	Tke Minimum	1.0E-10
| | | | |	Compressibility Correction	true
| | | | |	Low Re Damping Modification	false
| | | | |	Realizability Coefficient	2.8867513459481287
| | | | |	Sdr Minimum	1.0E-10
| | | | `-1 Compressibility Parameters	Zeta_Star	1.5
| | | +-8 Steady		
| | | +-9 Three Dimensional		

| | | `-10 Turbulent		
| | +-2 Reference Values		
| | | +-1 Minimum Allowable Wall Distance	Value	0.0010 mm
| | | `-2 Reference Pressure	Value	95000.0 Pa
| | `-3 Initial Conditions		
| | +-1 Pressure	Method	Constant
| | | `-1 Constant	Value	0.0 Pa
| | +-2 Turbulence Intensity	Method	Constant
| | | `-1 Constant	Value	0.01
| | +-3 Turbulence Specification	Method	Intensity + Viscosity Ratio
| | +-4 Turbulent Velocity Scale	Method	Constant
| | | `-1 Constant	Value	1.0 m/s
| | +-5 Turbulent Viscosity Ratio	Method	Constant
| | | `-1 Constant	Value	10.0
| | `-6 Velocity	Coordinate System	Laboratory
| | |	Method	Constant
| | `-1 Constant	Value	[69.44, 0.0, 0.0] m/s
| `-3 **Mesh 1**	OOC translation	false
| |	Verbose Output	false
| |	Per-Region Meshing	false
| |	Interfaces	[]
| |	Regions	[TUNNEL_CAR]
| +-1 Models		
| | +-1 Prism Layer Mesher	Stretching mode	Wall Thickness
| | |	Gap Fill Percentage	25.0
| | |	Minimum Thickness Percentage	5.0
| | |	Layer Reduction Percentage	0.0
| | |	Boundary March Angle	60.0
| | |	Concave Angle Limit	0.0
| | |	Convex Angle Limit	360.0
| | |	Generate Standard Cells Only	false
| | |	Improve Subsurface Quality	true
| | +-2 Surface Remesher	Do curvature refinement	true
| | |	Do proximity refinement	true
| | |	Minimum face quality	0.05
| | |	Enable automatic surface repair	false
| | `-3 Trimmer	Coordinate System	Laboratory
| |	Do curvature refinement	true
| |	Do proximity refinement	true
| |	Do mesh alignment	false
| |	Template mesh type	Hexahedra
| |	Template mesh growth type	Simple
| |	Run Optimizer	false
| +-2 Reference Values		
| | +-1 Thickness of Near Wall Prism Layer	Value	0.05 mm
| | +-2 Base Size	Value	1.0 mm
| | +-3 CAD Projection	Project to CAD	true
| | +-4 Maximum Cell Size	Size type	Relative to base
| | | `-1 Relative Size	Percentage of Base	204800.0
| | |	Absolute Size	2048.0 mm
| | +-5 Number of Prism Layers	Number of Prism	3

	Layers	
+-6 Prism Layer Thickness	Size type	Relative to base
`-1 Relative Size	Percentage of Base	5.0
	Absolute Size	0.05 mm
+-7 Surface Curvature	# Pts/circle	36.0
+-8 Surface Growth Rate	Surface Growth Rate	1.2
+-9 Surface Proximity	# Points in gap	2.0
	Search Floor	0.0 mm
+-10 Surface Size	Relative/Absolute	Relative to base
	Size Method	Min and Target
+-1 Relative Minimum Size	Percentage of Base	25.0
	Absolute Size	0.25 mm
`-2 Relative Target Size	Percentage of Base	100.0
	Absolute Size	1.0 mm
`-11 Template Growth Rate	Default Growth Rate	Medium
	Surface Growth Rate	Medium
`-3 Volumetric Controls		
+-1 **Diffuser**	Part Group	[]
	Shapes	[Diffuser, Underbody]
+-1 Mesh Conditions		
+-1 Prism Layer Mesher	Customize prism layer mesher	Disabled
+-2 Surface Remesher	Customize surface remesher	Disabled
`-3 Trimmer	Customize isotropic size	Enabled
	Customize anisotropic size	Disabled
`-2 Mesh Values		
`-1 Custom Size	Size type	Relative to base
`-1 Relative Size	Percentage of Base	6400.0
	Absolute Size	64.0 mm
+-2 **Full_car**	Part Group	[]
	Shapes	[Full_Car]
+-1 Mesh Conditions		
+-1 Prism Layer Mesher	Customize prism layer mesher	Disabled
+-2 Surface Remesher	Customize surface remesher	Disabled
`-3 Trimmer	Customize isotropic size	Enabled
	Customize anisotropic size	Disabled
`-2 Mesh Values		
`-1 Custom Size	Size type	Relative to base
`-1 Relative Size	Percentage of Base	6400.0
	Absolute Size	64.0 mm
+-3 **inlet_full_car**	Part Group	[]
	Shapes	[inlet_fullcar]
+-1 Mesh Conditions		
+-1 Prism Layer Mesher	Customize prism layer mesher	Disabled
+-2 Surface Remesher	Customize surface remesher	Disabled
`-3 Trimmer	Customize isotropic size	Enabled
	Customize anisotropic size	Disabled
`-2 Mesh Values		
`-1 Custom Size	Size type	Relative to base
`-1 Relative Size	Percentage of Base	6400.0
	Absolute Size	64.0 mm
+-4 **inlet_underbody**	Part Group	[]
	Shapes	[inlet_underbody]

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| | +-1 Mesh Conditions		
| | | +-1 Prism Layer Mesher	Customize prism layer mesher	Disabled
| | | +-2 Surface Remesher	Customize surface remesher	Enabled
| | | `-3 Trimmer	Customize isotropic size	Disabled
| | |	Customize anisotropic size	Enabled
| | `-2 Mesh Values		
| | +-1 Custom Size	Size type	Absolute
| | | `-1 Absolute Size	Value	50.0 mm
| | `-2 Trimmer Anisotropic Size	Relative/Absolute	Relative to base
| | |	Custom X size	Disabled
| | |	Custom Y size	Enabled
| | |	Custom Z size	Enabled
| | +-1 Relative Y Size	Percentage of Base	400.0
| | |	Absolute Size	4.0 mm
| | `-2 Relative Z Size	Percentage of Base	400.0
| |	Absolute Size	4.0 mm
| +-5 **rear_wake_1**	Part Group	[]
| | |	Shapes	[rear_wake_1]
| | +-1 Mesh Conditions		
| | | +-1 Prism Layer Mesher	Customize prism layer mesher	Disabled
| | | +-2 Surface Remesher	Customize surface remesher	Disabled
| | | `-3 Trimmer	Customize isotropic size	Enabled
| | |	Customize anisotropic size	Disabled
| | `-2 Mesh Values		
| | `-1 Custom Size	Size type	Relative to base
| | | `-1 Relative Size	Percentage of Base	12800.0
| |	Absolute Size	128.0 mm
| `-6 **rear_wing**	Part Group	[]
| |	Shapes	[Rear_wing]
| +-1 Mesh Conditions		
| | +-1 Prism Layer Mesher	Customize prism layer mesher	Disabled
| | +-2 Surface Remesher	Customize surface remesher	Disabled
| | `-3 Trimmer	Customize isotropic size	Enabled
| |	Customize anisotropic size	Disabled
| `-2 Mesh Values		
| `-1 Custom Size	Size type	Relative to base
| | `-1 Relative Size	Percentage of Base	800.0
|	Absolute Size	8.0 mm
+-4 Regions	Regions	1
| `-1 **TUNNEL_CAR**	Index	0
| |	Physics Continuum	K_omega
| |	Type	Fluid Region
| |	Mesh Continuum	Mesh 1
| |	Parts	[]
| +-1 Boundaries	Boundaries	16
| | +-1 **BODYWORK**	Index	22
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface	Custom curvature	Use Continuum Values

Curvature		
| | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | +-2 Mesh Values		
| | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	1600.0
| | | |	Absolute Size	16.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	12800.0
| | | |	Absolute Size	128.0 mm
| | | +-3 Physics Conditions		
| | | +-1 Shear Stress Specification	Method	No-Slip
| | | +-2 Tangential Velocity Specification	Method	None
| | | |	Reference Frame	Relative To Mesh
| | | `-3 Wall Surface Specification	Method	Smooth
| | `-4 Physics Values		
| | | `-1 Blended Wall Function	Kappa	0.42
| | |	E	9.0
| | +-2 **DIFFUSER**	Index	2
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | +-2 Mesh Values		
| | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	800.0
| | | |	Absolute Size	8.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	6400.0
| | | |	Absolute Size	64.0 mm
| | | +-3 Physics Conditions		
| | | +-1 Shear Stress Specification	Method	No-Slip
| | | +-2 Tangential Velocity Specification	Method	None
| | | |	Reference Frame	Relative To Mesh
| | | `-3 Wall Surface Specification	Method	Smooth
| | `-4 Physics Values		
| | | `-1 Blended Wall Function	Kappa	0.42
| | |	E	9.0

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| | +-3 **GROUND**	Index	4
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | +-2 Mesh Values		
| | | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	25600.0
| | | | |	Absolute Size	256.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	204800.0
| | | |	Absolute Size	2048.0 mm
| | | +-3 Physics Conditions		
| | | | +-1 Shear Stress Specification	Method	No-Slip
| | | | +-2 Tangential Velocity Specification	Method	Vector
| | | | |	Reference Frame	Relative To Mesh
| | | | `-3 Wall Surface Specification	Method	Smooth
| | | `-4 Physics Values		
| | | +-1 Blended Wall Function	Kappa	0.42
| | | |	E	9.0
| | | `-2 Velocity	Coordinate System	Laboratory
| | | |	Method	Constant
| | | `-1 Constant	Value	[69.44, 0.0, 0.0] m/s
| | +-4 **GROUND_PRISM**	Index	5
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | +-2 Mesh Values		
| | | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	12800.0
| | | | |	Absolute Size	128.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	53200.0
| | | |	Absolute Size	532.0 mm
| | | +-3 Physics Conditions		
| | | | +-1 Shear Stress	Method	No-Slip

Specification		
| | | +-2 Tangential Velocity Specification	Method	Vector
| | | |	Reference Frame	Relative To Mesh
| | | `-3 Wall Surface Specification	Method	Smooth
| | `-4 Physics Values		
| | +-1 Blended Wall Function	Kappa	0.42
| | |	E	9.0
| | `-2 Velocity	Coordinate System	Laboratory
| | |	Method	Constant
| | `-1 Constant	Value	[69.44, 0.0, 0.0] m/s
| +-5 **INLET**	Index	6
| | |	Part Surfaces	[]
| | |	Type	Velocity Inlet
| | |	Interfaces	
| | +-1 Mesh Conditions		
| | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Enabled
| | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | +-2 Mesh Values		
| | | +-1 Surface Growth Rate	Surface Growth Rate	Medium
| | | `-2 Surface Size	Relative/Absolute	Relative to base
| | | |	Size Method	Min and Target
| | | +-1 Relative Minimum Size	Percentage of Base	800.0
| | | |	Absolute Size	8.0 mm
| | | `-2 Relative Target Size	Percentage of Base	204800.0
| | |	Absolute Size	2048.0 mm
| | +-3 Physics Conditions		
| | | +-1 Flow Direction Specification	Method	Components
| | | +-2 Turbulence Specification	Method	Intensity + Viscosity Ratio
| | | `-3 Velocity Specification	Method	Magnitude + Direction
| | `-4 Physics Values		
| | | +-1 Flow Direction	Coordinate System	Laboratory
| | | | |	Method	Table (x,y,z)
| | | | `-1 Table (x,y,z)	Table: X-Coordinate	X
| | | |	Table: Y-Coordinate	Y
| | | |	Table: Z-Coordinate	Z
| | | |	Coordinate System	Laboratory
| | | |	Table: X-Data	Velocity[i]
| | | |	Table: Y-Data	Velocity[j]
| | | |	Table: Z-Data	Velocity[k]
| | | |	Table	Input_Rear_Wing_Optimization
| | | +-2 Turbulence Intensity	Method	Constant
| | | | `-1 Constant	Value	0.01
| | | +-3 Turbulent Viscosity Ratio	Method	Table (x,y,z)
| | | | `-1 Table (x,y,z)	Table: X-Coordinate	X
| | | |	Table: Y-Coordinate	Y
| | | |	Table: Z-Coordinate	Z
| | | |	Coordinate System	Laboratory
| | | |	Table: Data	Turbulent Viscosity Ratio

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| | | |	Table	Input_Rear_Wing_Optimization
| | | `-4 Velocity Magnitude	Method	Table (x,y,z)
| | | `-1 Table (x,y,z)	Table: X-Coordinate	X
| | |	Table: Y-Coordinate	Y
| | |	Table: Z-Coordinate	Z
| | |	Coordinate System	Laboratory
| | |	Table: Data	Velocity: Magnitude
| | |	Table	Input_Rear_Wing_Optimization
| | +-6 **OUTLET**	Index	7
| | | |	Part Surfaces	[]
| | | |	Type	Pressure Outlet
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | +-2 Mesh Values		
| | | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | | +-1 Relative Minimum Size	Percentage of Base	102400.0
| | | | |	Absolute Size	1024.0 mm
| | | | | `-2 Relative Target Size	Percentage of Base	204800.0
| | | |	Absolute Size	2048.0 mm
| | | +-3 Physics Conditions		
| | | | +-1 Backflow Direction Specification	Method	Boundary-Normal
| | | | +-2 Target Mass Flow Option	Target Mass Flow Option	Disabled
| | | | `-3 Turbulence Specification	Method	Intensity + Viscosity Ratio
| | | `-4 Physics Values		
| | | +-1 Pressure	Method	Constant
| | | | `-1 Constant	Value	0.0 Pa
| | | +-2 Turbulence Intensity	Method	Constant
| | | | `-1 Constant	Value	0.01
| | | `-3 Turbulent Viscosity Ratio	Method	Constant
| | | `-1 Constant	Value	10.0
| | +-7 **Rear_wing_test1**	Index	23
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Specify Custom Values
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | +-2 Mesh Values		

| | | | +-1 Thickness of Near Wall Prism Layer	Value	0.02 mm
| | | | +-2 Number of Prism Layers	Number of Prism Layers	3
| | | | +-3 Prism Layer Thickness	Size type	Absolute
| | | | | `-1 Absolute Size	Value	2.0 mm
| | | | `-4 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	50.0
| | | | |	Absolute Size	0.5 mm
| | | | `-2 Relative Target Size	Percentage of Base	1200.0
| | | |	Absolute Size	12.0 mm
| | | +-3 Physics Conditions		
| | | | +-1 Shear Stress Specification	Method	No-Slip
| | | | +-2 Tangential Velocity Specification	Method	None
| | | | |	Reference Frame	Relative To Mesh
| | | | `-3 Wall Surface Specification	Method	Smooth
| | | `-4 Physics Values		
| | | `-1 Blended Wall Function	Kappa	0.42
| | |	E	9.0
| | +-8 **RIM**	Index	17
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | +-2 Mesh Values		
| | | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	400.0
| | | | |	Absolute Size	4.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	3200.0
| | | |	Absolute Size	32.0 mm
| | | +-3 Physics Conditions		
| | | | +-1 Shear Stress Specification	Method	No-Slip
| | | | +-2 Tangential Velocity Specification	Method	Local Rotation Rate
| | | | |	Reference Frame	Relative To Mesh
| | | | `-3 Wall Surface Specification	Method	Smooth
| | | `-4 Physics Values		
| | | +-1 Axis	Direction	[0.0, -1.0, 0.0]
| | | |	Coordinate System	Laboratory->Wheel Axis
| | | |	Origin	[0.0, 0.0, 0.0] mm
| | | +-2 Blended Wall Function	Kappa	0.42
| | | |	E	9.0
| | | `-3 Wall Rotation	Method	Constant
| | | `-1 Constant	Value	2056.0 rpm

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| | +-9 **RL_CALIPER**	Index	21
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | +-2 Mesh Values		
| | | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	200.0
| | | | |	Absolute Size	2.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	3200.0
| | | |	Absolute Size	32.0 mm
| | | +-3 Physics Conditions		
| | | | +-1 Shear Stress Specification	Method	No-Slip
| | | | +-2 Tangential Velocity Specification	Method	None
| | | | |	Reference Frame	Relative To Mesh
| | | | `-3 Wall Surface Specification	Method	Smooth
| | | `-4 Physics Values		
| | | `-1 Blended Wall Function	Kappa	0.42
| | |	E	9.0
| | +-10 **RL_DISC**	Index	9
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | +-2 Mesh Values		
| | | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	800.0
| | | | |	Absolute Size	8.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	6400.0
| | | |	Absolute Size	64.0 mm
| | | +-3 Physics Conditions		
| | | | +-1 Shear Stress Specification	Method	No-Slip
| | | | +-2 Tangential Velocity Specification	Method	Local Rotation Rate

Reference Frame	Relative To Mesh	
`-3 Wall Surface Specification	Method	Smooth
`-4 Physics Values		
+-1 Axis	Direction	[0.0, -1.0, 0.0]
	Coordinate System	Laboratory->Wheel Axis
	Origin	[0.0, 0.0, 0.0] mm
+-2 Blended Wall Function	Kappa	0.42
	E	9.0
`-3 Wall Rotation	Method	Constant
`-1 Constant	Value	2056.0 rpm
+-11 **RL_DRUM**	Index	10
	Part Surfaces	[]
	Type	Wall
	Interfaces	
+-1 Mesh Conditions		
+-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
+-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
+-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
+-4 Custom Surface Size	Custom surface size	Enabled
+-5 Customize Prism Mesh	Customize Prism Mesh	Disable
`-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
+-2 Mesh Values		
`-1 Surface Size	Relative/Absolute	Relative to base
	Size Method	Min and Target
+-1 Relative Minimum Size	Percentage of Base	400.0
	Absolute Size	4.0 mm
`-2 Relative Target Size	Percentage of Base	3200.0
	Absolute Size	32.0 mm
+-3 Physics Conditions		
+-1 Shear Stress Specification	Method	No-Slip
+-2 Tangential Velocity Specification	Method	None
	Reference Frame	Relative To Mesh
`-3 Wall Surface Specification	Method	Smooth
`-4 Physics Values		
`-1 Blended Wall Function	Kappa	0.42
	E	9.0
+-12 **RL_WISHBONES**	Index	13
	Part Surfaces	[]
	Type	Wall
	Interfaces	
+-1 Mesh Conditions		
+-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
+-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
+-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
+-4 Custom Surface Size	Custom surface size	Enabled
+-5 Customize Prism Mesh	Customize Prism Mesh	Disable
`-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
+-2 Mesh Values		
`-1 Surface Size	Relative/Absolute	Relative to base

| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	200.0
| | | | |	Absolute Size	2.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	3200.0
| | | |	Absolute Size	32.0 mm
| | +-3 Physics Conditions		
| | | +-1 Shear Stress Specification	Method	No-Slip
| | | +-2 Tangential Velocity Specification	Method	None
| | | | |	Reference Frame	Relative To Mesh
| | | `-3 Wall Surface Specification	Method	Smooth
| | `-4 Physics Values		
| | | `-1 Blended Wall Function	Kappa	0.42
| | |	E	9.0
| | +-13 **SYM**	Index	24
| | | |	Part Surfaces	[]
| | | |	Type	Symmetry Plane
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | `-2 Mesh Values		
| | | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	800.0
| | | | |	Absolute Size	8.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	204800.0
| | |	Absolute Size	2048.0 mm
| | +-14 **TUNNEL**	Index	15
| | | |	Part Surfaces	[]
| | | |	Type	Wall
| | | |	Interfaces	
| | | +-1 Mesh Conditions		
| | | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | | +-2 Mesh Values		
| | | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | | |	Size Method	Min and Target
| | | | +-1 Relative Minimum Size	Percentage of Base	102400.0
| | | | |	Absolute Size	1024.0 mm
| | | | `-2 Relative Target Size	Percentage of Base	204800.0

| | |	Absolute Size	2048.0 mm
| | `-3 Physics Conditions		
| | | `-1 Shear Stress Specification	Method	Slip
| +-15 **TYRE**	Index	18
| | |	Part Surfaces	[]
| | |	Type	Wall
| | |	Interfaces	
| | +-1 Mesh Conditions		
| | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | +-2 Mesh Values		
| | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | |	Size Method	Min and Target
| | | +-1 Relative Minimum Size	Percentage of Base	1600.0
| | | |	Absolute Size	16.0 mm
| | | `-2 Relative Target Size	Percentage of Base	55200.0
| | |	Absolute Size	552.0 mm
| | +-3 Physics Conditions		
| | | +-1 Shear Stress Specification	Method	No-Slip
| | | +-2 Tangential Velocity Specification	Method	Local Rotation Rate
| | | |	Reference Frame	Relative To Mesh
| | | `-3 Wall Surface Specification	Method	Smooth
| | `-4 Physics Values		
| | +-1 Axis	Direction	[0.0, -1.0, 0.0]
| | |	Coordinate System	Laboratory->Wheel Axis
| | |	Origin	[0.0, 0.0, 0.0] mm
| | +-2 Blended Wall Function	Kappa	0.42
| | |	E	9.0
| | `-3 Wall Rotation	Method	Constant
| | | `-1 Constant	Value	2056.0 rpm
| `-16 **UNDERFLOOR**	Index	16
| |	Part Surfaces	[]
| |	Type	Wall
| |	Interfaces	
| | +-1 Mesh Conditions		
| | | +-1 Custom Surface Curvature	Custom curvature	Use Continuum Values
| | | +-2 Custom Surface Growth Rate	Custom Surface Growth Rate	Disabled
| | | +-3 Custom Surface Proximity	Custom proximity	Use Continuum Values
| | | +-4 Custom Surface Size	Custom surface size	Enabled
| | | +-5 Customize Prism Mesh	Customize Prism Mesh	Disable
| | | `-6 Customize Surface Remeshing	Disable Surface Remeshing	Disabled
| | +-2 Mesh Values		
| | | `-1 Surface Size	Relative/Absolute	Relative to base
| | | |	Size Method	Min and Target
| | | +-1 Relative Minimum	Percentage of Base	1600.0

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Size		
| | | |	Absolute Size	16.0 mm
| | | `-2 Relative Target Size	Percentage of Base	12800.0
| | |	Absolute Size	128.0 mm
| | +-3 Physics Conditions		
| | | +-1 Shear Stress Specification	Method	No-Slip
| | | +-2 Tangential Velocity Specification	Method	None
| | | |	Reference Frame	Relative To Mesh
| | | `-3 Wall Surface Specification	Method	Smooth
| | `-4 Physics Values		
| | `-1 Blended Wall Function	Kappa	0.42
| |	E	9.0
| +-2 Feature Curves	Feature Curves	2
| | +-1 **Car_curves**	Part Curves	[]
| | | `-1 Mesh Conditions		
| | | `-1 Custom Surface Size	Custom surface size	Disabled
| | `-2 **Tunnel_curves**	Part Curves	[]
| | `-1 Mesh Conditions		
| | `-1 Custom Surface Size	Custom surface size	Disabled
| +-3 Mesh Conditions		
| | `-1 Customize Prism Mesh	Customize Prism Mesh	Use Default Values
| +-4 Mesh Values		
| | `-1 Trimmer Wake Refinement		
| +-5 Physics Conditions		
| | +-1 Initial Condition Option	Option	Use Continuum Values
| | +-2 Mass Source Option	Mass Source Option	Disabled
| | +-3 Momentum Source Option	Momentum Source Option	None
| | `-4 Turbulence Source Option	Turbulence Source Option	None
| `-6 Physics Values		
| +-1 Axis	Direction	[0.0, 0.0, 1.0]
| |	Coordinate System	Laboratory
| |	Origin	[0.0, 0.0, 0.0] mm
| `-2 Motion Specification	Motion	Stationary
|	Reference Frame	Lab Reference Frame
+-5 Derived Parts	Derived Parts	6
| +-1 **constrained streamline**	Seed Type	Part
| | |	Rotation Scale	1.0
| | |	Integration Solver	2nd-Order RK
| | |	Vector Field	Cell Relative Velocity
| | |	Parts	[TUNNEL_CAR: Rear_wing_test1]
| | +-1 Source Seed	Seed Parts	[TUNNEL_CAR: Rear_wing_test1]
| | |	On Ratio	442
| | |	Randomize	false
| | |	N Grid Points	[25, 25]
| | `-2 2nd Order Integrator	Integration Direction	Both
| |	Initial Integration Step	0.5
| |	Maximum Propagation	20.0
| |	Max Steps	2000
| +-2 **plane section**	Coordinate System	Laboratory
| | |	Origin	[0.0, -300.0, 0.0] mm,mm,mm
| | |	Normal	[0.0, 1.0, 0.0] mm,mm,mm
| | |	Section Mode	Single Section
| | |	Parts	[TUNNEL_CAR]
| | `-1 Single section	Offset	0.0
| +-3 **plane section 2**	Coordinate System	Laboratory
| | |	Origin	[0.0, -100.0, 0.0] mm,mm,mm

Normal	[0.0, 1.0, 0.0] mm,mm,mm
Section Mode	Single Section
Parts	[TUNNEL_CAR: Rear_wing_test1]
Single section	
Offset	0.0
Tyre_rotation_check	
Coordinate System	Laboratory
Origin	[0.0, -700.0, 0.0] mm,mm,mm
Normal	[0.0, 1.0, 0.0] mm,mm,mm
Section Mode	Single Section
Parts	[TUNNEL_CAR]
Single section	
Offset	0.0
threshold	
Mode	Between
Scalar Field	Turbulent Kinetic Energy
Range	[2000000.0, 6.8720975872E10]
Size	0
Parts	[TUNNEL_CAR]
X_norm	
Coordinate System	Laboratory
Origin	[3200.0, -0.0, 0.0] mm,mm,mm
Normal	[1.0, 0.0, 0.0] m,m,m
Section Mode	Single Section
Parts	[TUNNEL_CAR]
Single section	
Offset	0.0
Solvers	
Wall Distance	
Parallel memory optimization scaling factor	1.0
Solver Frozen	false
Segregated Flow	
Reconstruction Frozen	false
Reconstruction Zeroed	false
Temporary Storage Retained	false
Solver Frozen	false
Velocity	
Under-Relaxation Factor	0.4
Under-Relaxation Factor Ramp	
Ramp Method	No Ramp
AMG Linear Solver	
Verbosity	None
Max Cycles	30
Parallel Migration Limit	25
Extra partition-boundary sweeps	1
Enable new coarsening algorithm	true
Enable direct-solver	false
Maximum direct-solver equations	32
Convergence Tolerance	0.1
Epsilon	0.0
Cycle Type	Flex Cycle
Group Size Control	Auto
Group Size	4
Relaxation Scheme	Gauss-Seidel
Acceleration method	None
Scaling	Disabled
Flex Cycle	
Restriction Tolerance	0.9
Prolongation Tolerance	0.5
Sweeps	1
Pressure	
Under-Relaxation Factor	0.1
Pressure Reference Location	Automatic Selection

+-1 Under-Relaxation Factor Ramp	Ramp Method: No Ramp
`-2 AMG Linear Solver	Verbosity: None
	Max Cycles: 30
	Parallel Migration Limit: 25
	Extra partition-boundary sweeps: 1
	Enable new coarsening algorithm: true
	Enable direct-solver: false
	Maximum direct-solver equations: 32
	Convergence Tolerance: 0.1
	Epsilon: 0.0
	Cycle Type: F Cycle
	Group Size Control: Auto
	Group Size: 4
	Relaxation Scheme: Gauss-Seidel
	Acceleration method: None
	Scaling: Auto
`-1 F Cycle	Pre-Sweeps: 0
	Post-Sweeps: 2
	Max Levels: 50
+-3 K-Omega Turbulence	Under-Relaxation Factor: 0.8
	Reconstruction Frozen: false
	Reconstruction Zeroed: false
	Temporary Storage Retained: false
	Solver Frozen: false
+-1 Under-Relaxation Factor Ramp	Ramp Method: No Ramp
`-2 AMG Linear Solver	Verbosity: None
	Max Cycles: 30
	Parallel Migration Limit: 25
	Extra partition-boundary sweeps: 1
	Enable new coarsening algorithm: true
	Enable direct-solver: false
	Maximum direct-solver equations: 32
	Convergence Tolerance: 0.1
	Epsilon: 0.0
	Cycle Type: Flex Cycle
	Group Size Control: Auto
	Group Size: 4
	Relaxation Scheme: Gauss-Seidel
	Acceleration method: None
	Scaling: Disabled
`-1 Flex Cycle	Restriction Tolerance: 0.9
	Prolongation Tolerance: 0.5
	Sweeps: 1
`-4 K-Omega Turbulent Viscosity	Under-Relaxation Factor: 1.0
	Maximum Ratio: 100000.0
	Solver Frozen: false
+-7 Stopping Criteria	
+-1 **Maximum Steps**	Maximum Steps: 1501
	Enabled: true

| |	Criterion Satisfied	false
| |	Logical Rule	Or
| `-2 **Stop File**	Stop Inner Iterations	true
|	Path	ABORT
|	Enabled	true
|	Criterion Satisfied	false
|	Logical Rule	Or
+-8 Reports	Reports	2
| +-1 **Fx**	Coordinate System	Laboratory
| |	Force Option	Pressure + Shear
| |	Direction	[1.0, 0.0, 0.0]
| |	Reference Pressure	0.0 Pa
| |	Number of Bands	0
| |	Parts	[TUNNEL_CAR: Rear_wing_test1]
| |	Units	N
| `-2 **Fz**	Coordinate System	Laboratory
|	Force Option	Pressure + Shear
|	Direction	[0.0, 0.0, -1.0]
|	Reference Pressure	0.0 Pa
|	Number of Bands	0
|	Parts	[TUNNEL_CAR: Rear_wing_test1]
|	Units	N
+-9 Monitors	Monitors	11
| |	Monitors To Print	[Z-momentum, Tke, Sdr, Y-momentum, X-momentum, Continuity, Fz Monitor, Fx Monitor, Fx Monitor 2, Fz Monitor 2]
| |	Output Direction	Horizontal
| |	Heading Print Frequency	10
| +-1 **Fx Monitor**	Report	Fx
| |	Trigger	Iteration
| |	Maximum Plot Samples	5000
| |	Normalization Option	Off
| |	Frequency	1
| +-2 **Fx Monitor 2**	Report	Fx
| |	Trigger	Iteration
| |	Maximum Plot Samples	5000
| |	Normalization Option	Off
| |	Frequency	1
| +-3 **Fz Monitor**	Report	Fz
| |	Trigger	Iteration
| |	Maximum Plot Samples	5000
| |	Normalization Option	Off
| |	Frequency	1
| +-4 **Fz Monitor 2**	Report	Fz
| |	Trigger	Iteration
| |	Maximum Plot Samples	5000
| |	Normalization Option	Off
| |	Frequency	1
+-10 Representations		
| +-1 **Import**	Faces	5198354
| | |	Edges	56614
| | `-1 Regions		
| | `-1 TUNNEL_CAR	Faces	5198354
| | |	Edges	56614
| | +-1 Boundaries		
| | | +-1 BODYWORK	Faces	58527
| | | +-2 DIFFUSER	Faces	80048
| | | +-3 GROUND	Faces	579132
| | | +-4 GROUND_PRISM	Faces	19178
| | | +-5 INLET	Faces	841845

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| | | +-6 OUTLET	Faces	839808
| | | +-7 Rear_wing_test1	Faces	131831
| | | +-8 RIM	Faces	461044
| | | +-9 RL_CALIPER	Faces	148716
| | | +-10 RL_DISC	Faces	207742
| | | +-11 RL_DRUM	Faces	226445
| | | +-12 RL_WISHBONES	Faces	186419
| | | +-13 SYM	Faces	6125
| | | +-14 TUNNEL	Faces	1194912
| | | +-15 TYRE	Faces	185069
| | | `-16 UNDERFLOOR	Faces	31513
| | `-2 Feature Curves		
| | +-1 Car_curves	Edges	45436
| | `-2 Tunnel_curves	Edges	11178
| +-2 **Remeshed Surface**	Faces	813180
| | |	Edges	15652
| | `-1 Regions		
| | `-1 TUNNEL_CAR	Faces	813180
| | |	Edges	15652
| | +-1 Boundaries		
| | | +-1 BODYWORK	Faces	14469
| | | +-2 DIFFUSER	Faces	9748
| | | +-3 GROUND	Faces	401
| | | +-4 GROUND_PRISM	Faces	1481
| | | +-5 INLET	Faces	4297
| | | +-6 OUTLET	Faces	170
| | | +-7 Rear_wing_test1	Faces	522038
| | | +-8 RIM	Faces	57988
| | | +-9 RL_CALIPER	Faces	39101
| | | +-10 RL_DISC	Faces	9086
| | | +-11 RL_DRUM	Faces	70944
| | | +-12 RL_WISHBONES	Faces	60834
| | | +-13 SYM	Faces	9897
| | | +-14 TUNNEL	Faces	482
| | | +-15 TYRE	Faces	10134
| | | `-16 UNDERFLOOR	Faces	2110
| | `-2 Feature Curves		
| | +-1 Car_curves	Edges	14948
| | `-2 Tunnel_curves	Edges	704
| `-3 **Volume Mesh**	Cells	3111310
| |	Interior Faces	9345635
| |	Vertices	3620267
| +-1 Finite Volume Regions		
| | `-1 TUNNEL_CAR	Cells	3111310
| | |	Interior Faces	9345635
| | |	Vertices	3620267
| | `-1 Finite Volume Boundaries		
| | +-1 BODYWORK	Faces	22075
| | +-2 DIFFUSER	Faces	5953
| | +-3 GROUND	Faces	265
| | +-4 GROUND_PRISM	Faces	2443
| | +-5 INLET	Faces	7993
| | +-6 OUTLET	Faces	64
| | +-7 Rear_wing_test1	Faces	278130
| | +-8 RIM	Faces	40932
| | +-9 RL_CALIPER	Faces	24650
| | +-10 RL_DISC	Faces	22094
| | +-11 RL_DRUM	Faces	50006
| | +-12 RL_WISHBONES	Faces	41421
| | +-13 SYM	Faces	11422
| | +-14 TUNNEL	Faces	192

| | +-15 TYRE	Faces	8591
| | `-16 UNDERFLOOR	Faces	2303
| `-2 Cell Sets		
+-11 Coordinate Systems		
+-12 Tables		
| `-1 **Input_Rear_Wing_Optimization**	Path	\\Eedata01\metca_2010\PROJECTS_2010\F1_REAR_WING\Input_Rear_Wing_Optimization.csv
|	Extracted	[Velocity: Magnitude, Velocity[i], Velocity[j], Velocity[k], Turbulent Viscosity Ratio, X, Y, Z]
+-13 Units	Preferred System	Systeme Internationale
+-14 Field Functions		
+-15 Volume Shapes		
| +-1 **Cylinder 1**	Coordinate System	Laboratory
| |	Radius	25.0 mm
| |	Start Coordinate	[2800.0, 0.0, 870.0] mm,mm,mm
| |	End Coordinate	[2910.0, 0.0, 870.0] mm,mm,mm
| +-2 **Diffuser**	Coordinate System	Laboratory
| |	Corner1	[3240.0, -800.0, -40.0] mm,mm,mm
| |	Corner2	[3700.0, 800.0, 300.0] mm,mm,mm
| +-3 **Full_Car**	Coordinate System	Laboratory
| |	Corner1	[3700.0, -1100.0, 60.0] mm,mm,mm
| |	Corner2	[-1500.0, 1100.0, 1500.0] mm,mm,mm
| +-4 **inlet_fullcar**	Coordinate System	Laboratory
| |	Corner1	[2882.0, -1100.0, 60.0] mm,mm,mm
| |	Corner2	[2878.0, 1100.0, 1500.0] mm,mm,mm
| +-5 **inlet_underbody**	Coordinate System	Laboratory
| |	Corner1	[2882.0, -750.0, -40.0] mm,mm,mm
| |	Corner2	[2700.0, 780.0, 80.0] mm,mm,mm
| +-6 **Rear_wak_2**	Coordinate System	Laboratory
| |	Corner1	[5000.0, -2000.0, -40.0] mm,mm,mm
| |	Corner2	[7000.0, 2000.0, 2500.0] mm,mm,mm
| +-7 **Rear_wake_3**	Coordinate System	Laboratory
| |	Corner1	[7000.0, -2000.0, -40.0] mm,mm,mm
| |	Corner2	[9000.0, 2000.0, 3000.0] mm,mm,mm
| +-8 **Rear_wake_4**	Coordinate System	Laboratory
| |	Corner1	[9000.0, -2000.0, -40.0] mm,mm,mm
| |	Corner2	[19000.0, 2000.0, 3500.0] mm,mm,mm
| +-9 **Rear_wing**	Coordinate System	Laboratory
| |	Corner1	[3650.0, -370.0, 650.0] mm,mm,mm
| |	Corner2	[3200.0, 370.0, 1000.0] mm,mm,mm
| +-10 **rear_wake_1**	Coordinate System	Laboratory
| |	Corner1	[3700.0, -2000.0, -40.0] mm,mm,mm
| |	Corner2	[5000.0, 2000.0, 2000.0] mm,mm,mm
| `-11 **Underbody**	Coordinate System	Laboratory
|	Corner1	[950.0, -750.0, -40.0] mm,mm,mm
|	Corner2	[3240.0, 780.0, 80.0] mm,mm,mm
+-16 User Code		
+-17 Data Set Functions		
+-18 Layouts		
| `-1 default		
+-19 Data Mappers		
+-20 Motions		
| `-1 **Stationary**		
+-21 Reference Frames		
| `-1 **Lab Reference Frame**		
+-22 Material Databases		
| `-1 Standard	File name	props.mdb
| |	File path	C:\Program Files\CD-adapco\STAR-CCM+ 5.04.008
| +-1 Gases		
| | +-1 Air (Air)	Symbol	Air
| | | |	Title	Air
| | | +-1 Critical Pressure		
| | | | `-1 Constant	Value	3769000.0 Pa

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| | | +-2 Critical Temperature		
| | | | `-1 Constant	Value	132.55 K
| | | +-3 Density		
| | | | `-1 Constant	Value	1.18415 kg/m^3
| | | +-4 Dynamic Viscosity		
| | | | `-1 Constant	Value	1.85508E-5 Pa-s
| | | +-5 Heat of Formation		
| | | | `-1 Constant	Value	0.0 J/kg
| | | +-6 Latent Heat of Vaporization		
| | | | `-1 Constant	Value	960.551 J/kg
| | | +-7 Molecular Weight		
| | | | `-1 Constant	Value	28.9664 kg/kg.mol
| | | +-8 Saturation Pressure		
| | | | `-1 Constant	Value	1.24787E8 Pa
| | | +-9 Saturation Temperature		
| | | | `-1 Constant	Value	81.75 K
| | | +-10 Specific Heat		
| | | | `-1 Constant	Value	1003.62 J/kg-K
| | | +-11 Thermal Conductivity		
| | | | `-1 Constant	Value	0.0260305 W/m-K
| | | +-12 Thermal Expansion Coefficient		
| | | | `-1 Constant	Value	0.0 /K

Solution

Accumulated CPU Time over all processes (s)	141962.5600000005
Elapsed Time (s)	23737.218369831506
Iterations	1501

APPENDIX D - Example of CATIA Macro

Used when ModeFrontier cannot update the geometry due to the use of Design Tables in CATIA.

```
Language="VBSCRIPT"

Sub CATMain()

Set partDocument1 = CATIA.ActiveDocument

Set part1 = partDocument1.Part

Set parameters1 = part1.Parameters

Set angle1 = parameters1.Item("AoA1")

angle1.Value = <VAR name="alpha1" format="0.0000E0"/>

part1.Update

Set parameters2 = part1.Parameters

Set length1 = parameters2.Item("Part1\Wing_and_flap_Positioning\Flap_chord")

length1.Value = <VAR name="c1" format="0.0000E0"/>

part1.Update

Set hybridBodies1 = part1.HybridBodies

Set hybridBody1 = hybridBodies1.Item("Wing_and_flap_positioning")

Set sketches1 = hybridBody1.HybridSketches

Set sketch1 = sketches1.Item("Sketch.11")

Set constraints1 = sketch1.Constraints

Set constraint1 = constraints1.Item("Angle.67")

constraint1.AngleSector = catCstAngleSector1

Set parameters3 = part1.Parameters

Set length2 = parameters3.Item("section3_y")

length2.Value = <VAR name="y3" format="0.0000E0"/>

part1.Update

Set parameters4 = part1.Parameters

Set length3 = parameters4.Item("Chord4")

length3.Value = <VAR name="c4" format="0.0000E0"/>

part1.Update
```

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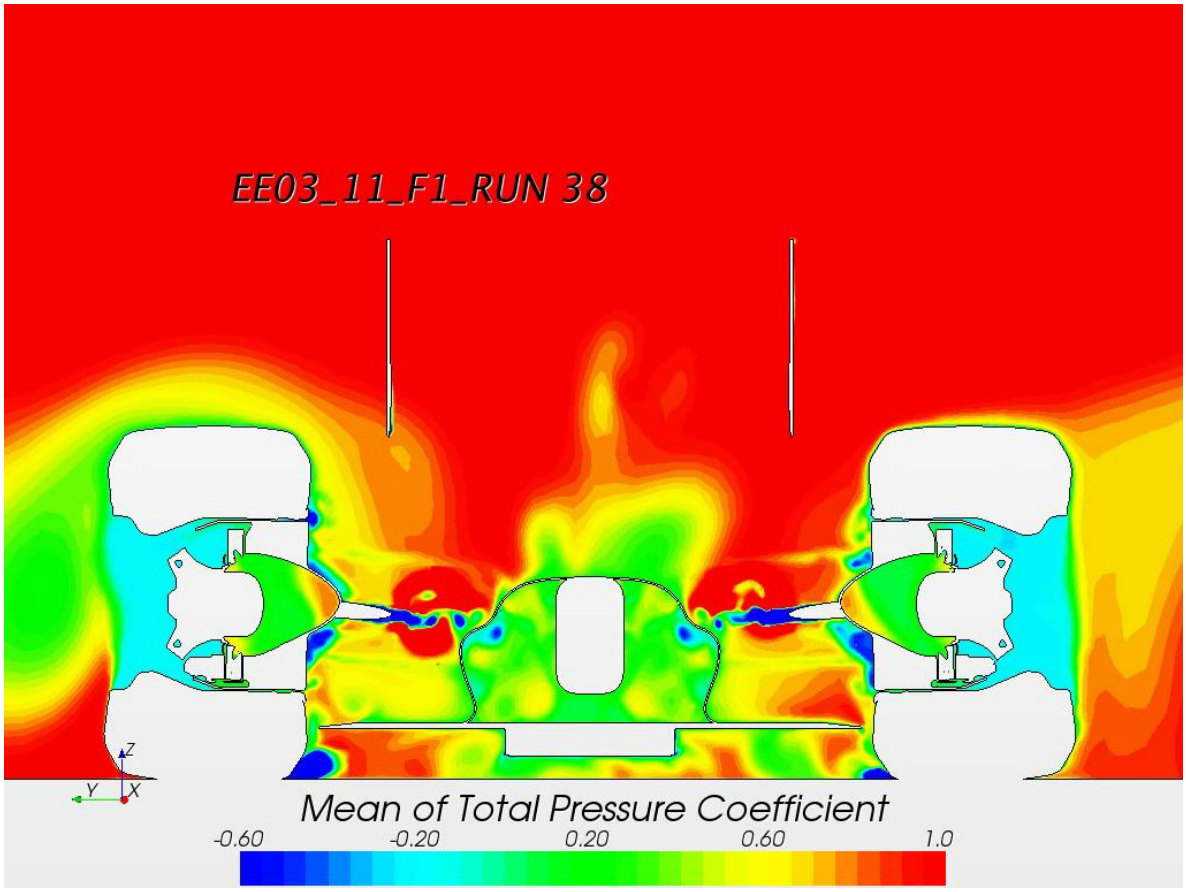
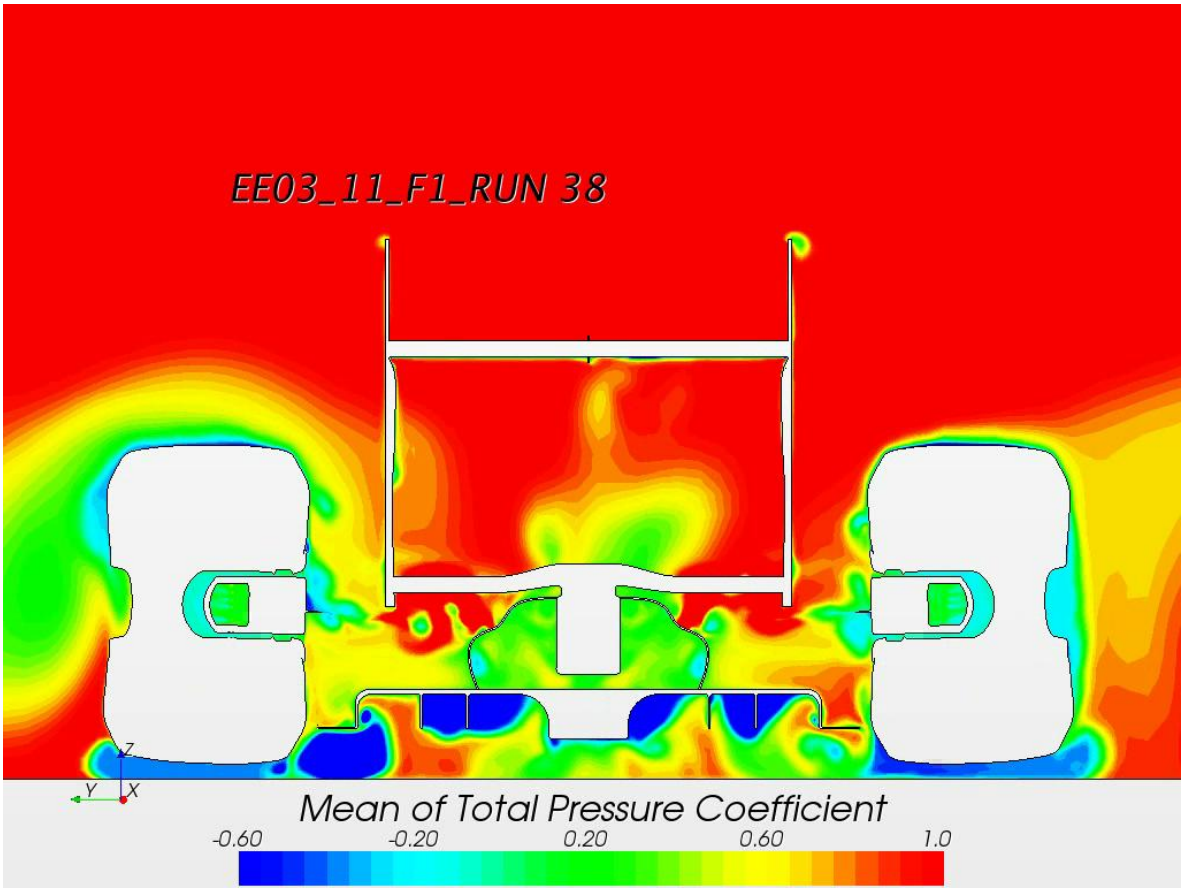
```
Set partDocument1 = CATIA.ActiveDocument

partDocument1.ExportData "C:\TEMPORAL\Modefrontier\NACA_PROFILE3D\NACA_BSL02_3D_V5.stl", "stl"

CATIA.Quit

End Sub
```

HIGHLIGHTED TEXT == MODEFRONTIER PARAMETERS VALUE

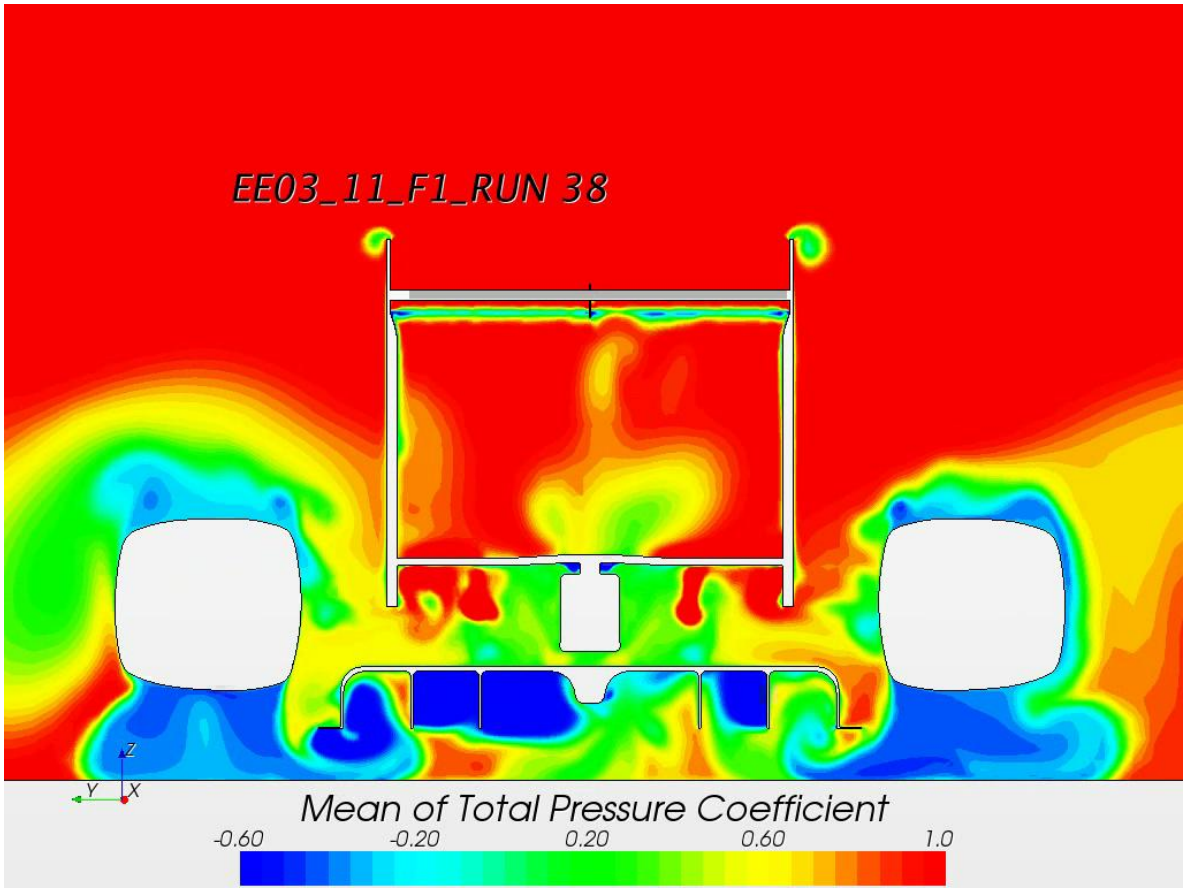
APPENDIX E-Comparison Baseline01(former baseline) Vs Baseline02



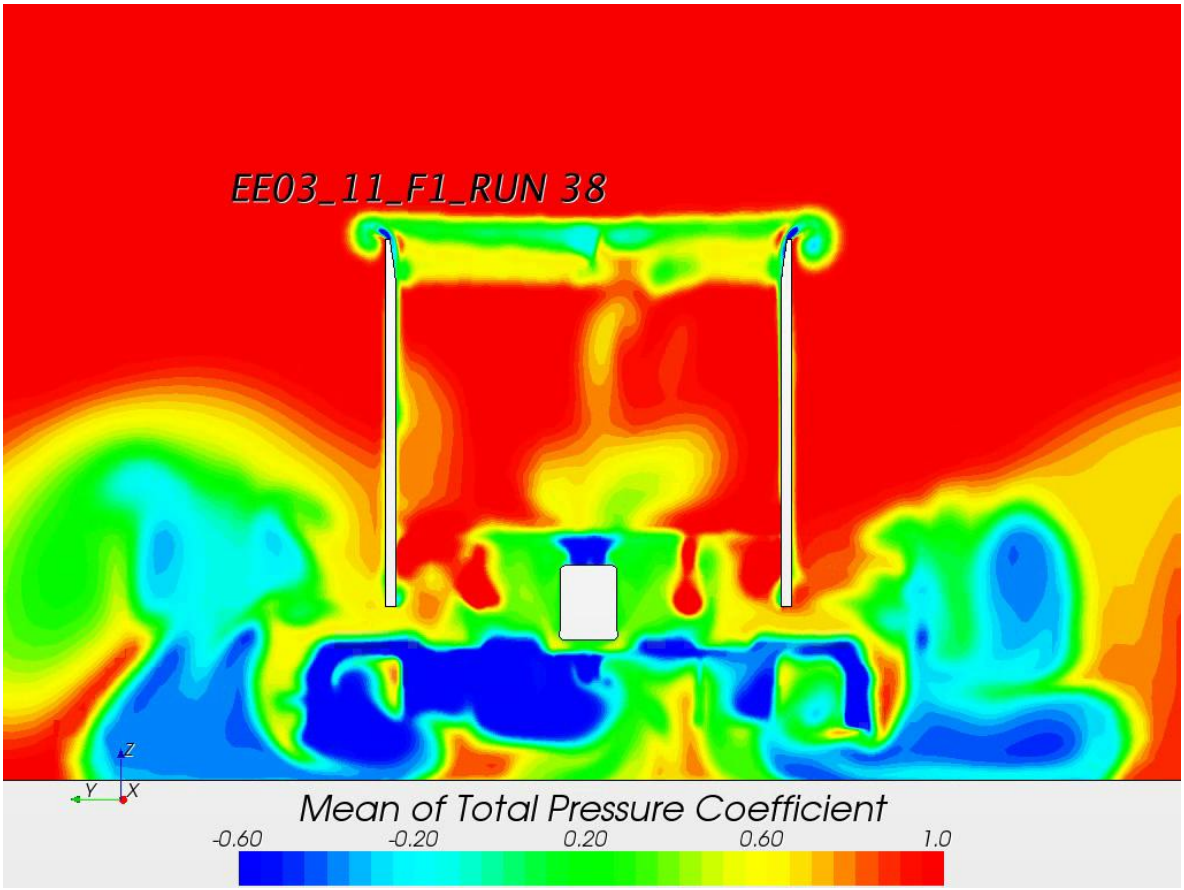
Baseline 01 X= 3230 mm



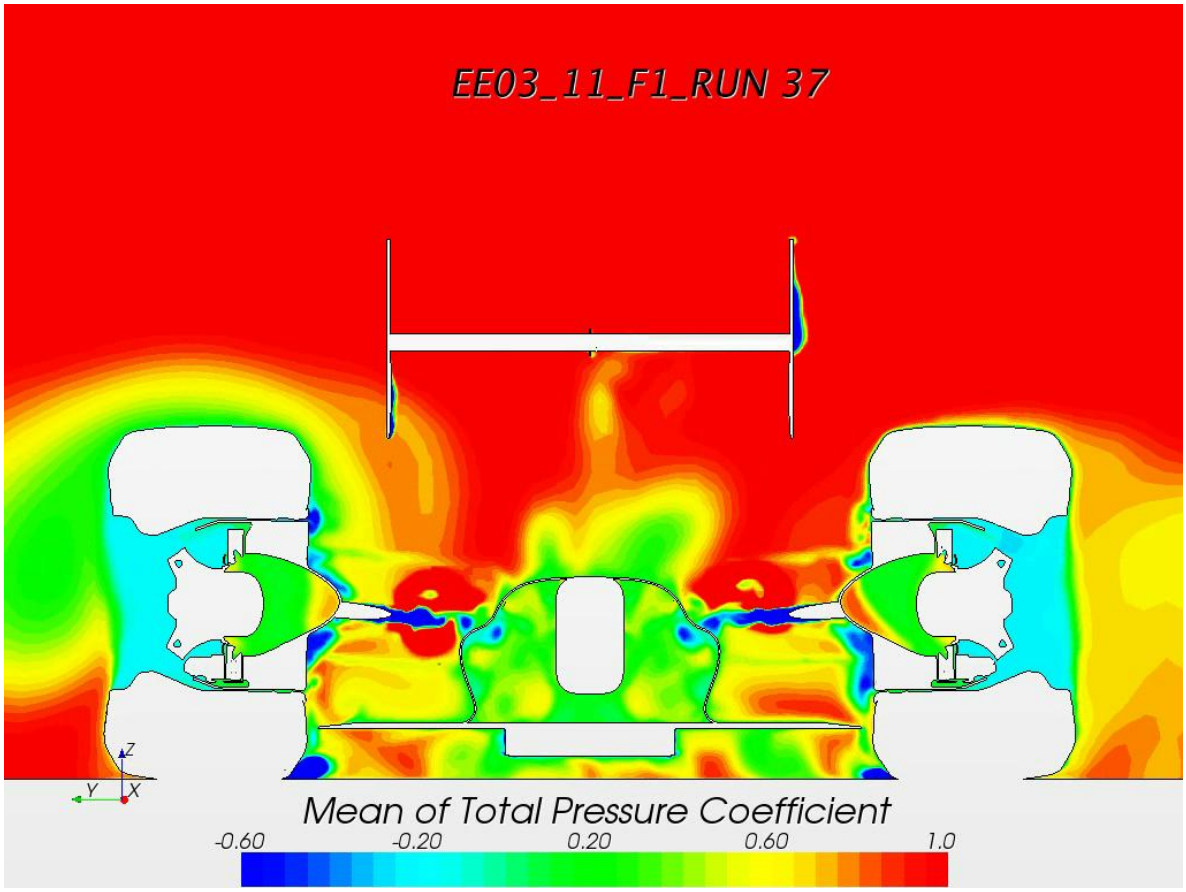
Baseline 01 X= 3390 mm



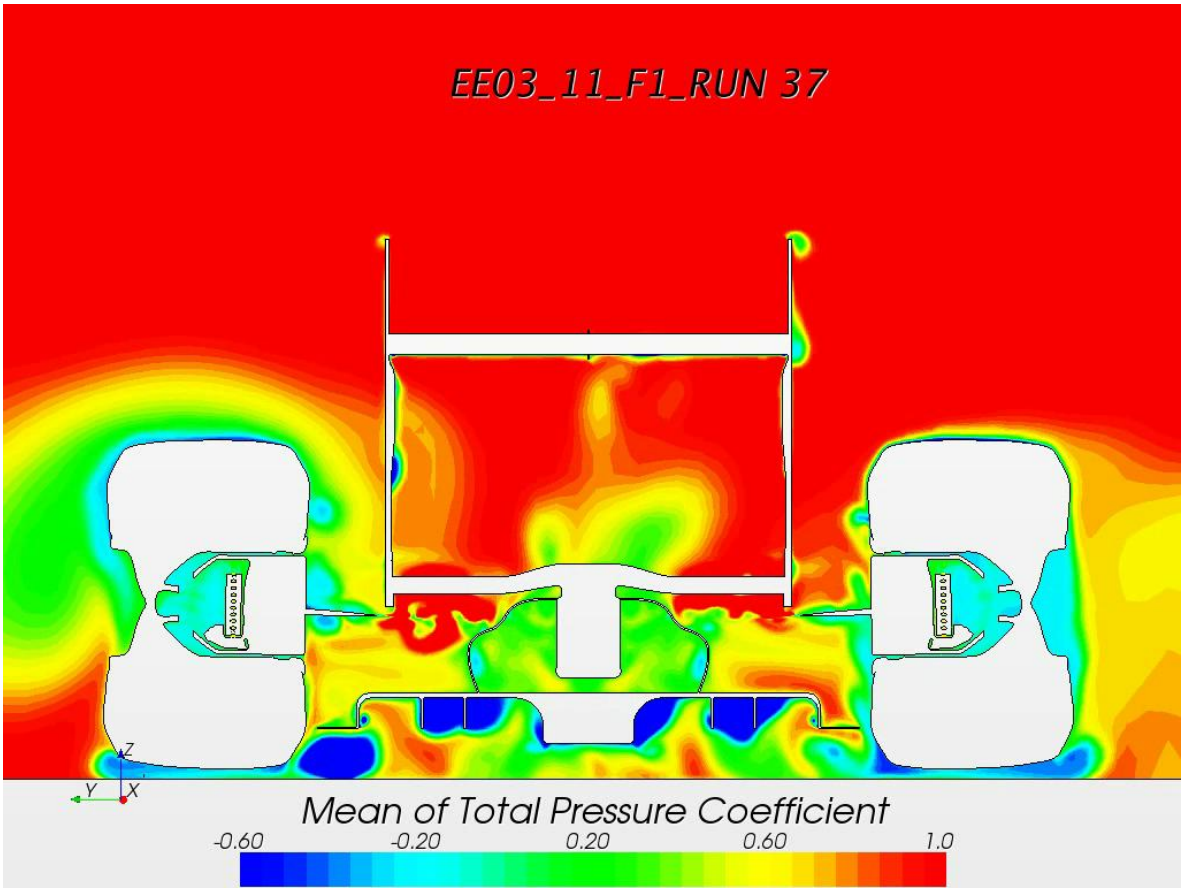
Baseline 01 X= 3530 mm



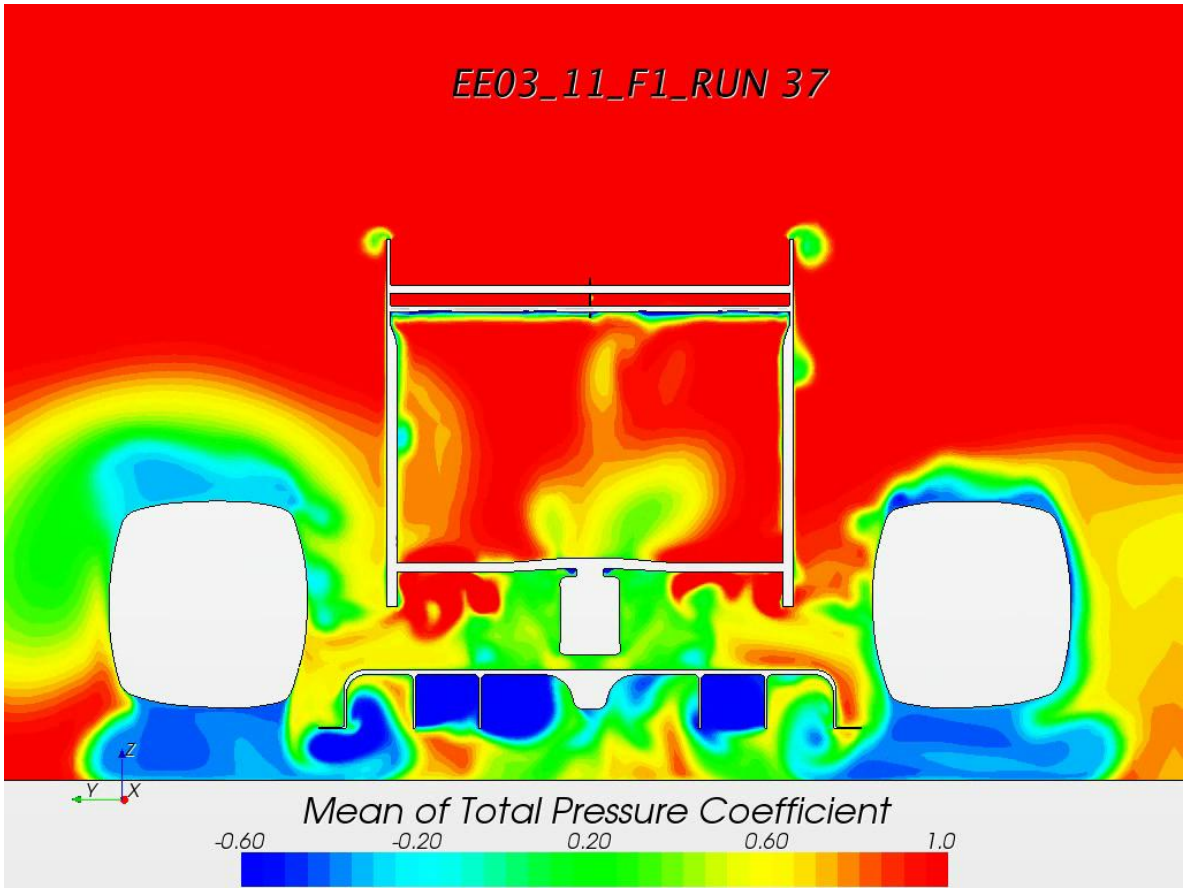
Baseline 01 X= 3610 mm



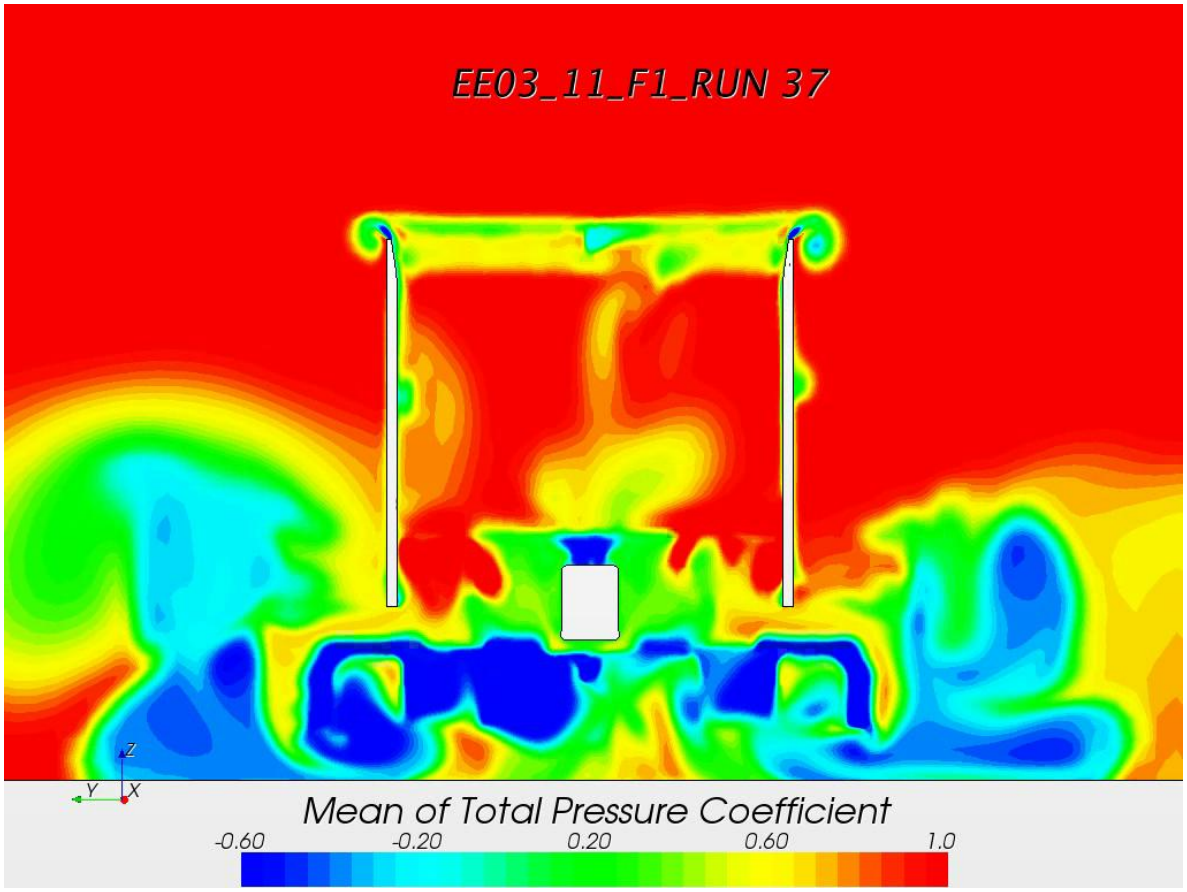
Baseline 02 X= 3230 mm



Baseline 02 X= 3390 mm



Baseline 02 X= 3530 mm



Baseline 02 X= 3610 mm